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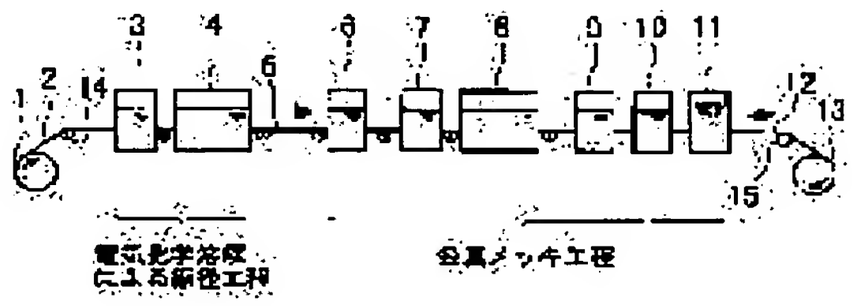
(54) EXTRAFINE WIRE AND ITS MANUFACTURING METHOD, METAL PLATED EXTRAFINE WIRE AND ITS MANUFACTURING METHOD, AND RESIN COATED EXTRAFINE WIRE AND ITS MANUFACTURING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an extrafine wire having excellent surface quality and suitable for electric/electronic apparatus wiring.
SOLUTION: This extrafine wire 5 is formed by reducing the diameter of a conductive element wire 2 drawn with a wire drawing machine by means of chemical dissolution or electrochemical dissolution. Since the extrafine wire 5 is formed by reducing the diameter of the conductive element wire 2 by means of chemical dissolution or electrochemical dissolution, the wire has excellent surface quality, and a metal plated extrafine wire 12 or resin coated extrafine wire using it hardly causes a defect such as a bulge.



CLAIMS

[Claim(s)]
[Claim 1]An extra fine wire, wherein the diameter of a conductive strand by which wire drawing was carried out with a wire drawing machine is reduced by the chemicals dissolution or the electrochemistry dissolution.
[Claim 2]A metal plating extra fine wire, wherein metal is plated by the extra fine wire according to claim 1.
[Claim 3]A resin coating extra fine wire, wherein resin is covered by the extra fine wire according to claim 1.
[Claim 4]A manufacturing method of an extra fine wire reducing the diameter of a conductive strand by which wire drawing was carried out with a wire drawing machine by the chemicals dissolution or the electrochemistry dissolution.
[Claim 5]A manufacturing method of a metal plating extra fine wire giving continuously a process which reduces the diameter of a conductive strand by which wire drawing was carried out with a wire drawing machine by the chemicals dissolution or the electrochemistry dissolution, and is used as an extra fine wire, and a process of plating metal to said extra fine wire.
[Claim 6]A manufacturing method of a resin coating extra fine wire giving continuously a process which reduces the diameter of a conductive strand by which wire drawing was carried out with a wire drawing machine by the chemicals dissolution or the electrochemistry dissolution, and is used as an extra fine wire, and a process of covering resin to said extra fine wire.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention is excellent in surface quality, and relates to the manufacturing method of an extra fine wire suitable for electrical-and-electric-equipment wiring etc., the metal plating extra fine wire which plated metal to said extra fine wire, the resin coating extra fine wire which covered resin to said extra fine wire, and said extra fine wire, the manufacturing method of said metal plating line, and the manufacturing method of said resin coating extra fine wire.
[0002]
[Description of the Prior Art]Conventionally, copper or the aluminum extra fine wire by which wire drawing was carried out to about 20 micrometers of wire sizes with the capstan type continuous wire drawing machine is used for electrical-and-electric-equipment wiring or a coil. Said capstan type continuous wire drawing machine is equipped with two or more dices, and wire drawing of 10 to 25% of fractional reduction in area is performed for every dice, and a conductive strand is processed into an extra fine wire, and is rolled round by the coiler. And said extra fine wire is processed into a metal plating extra fine wire or a resin coating extra fine wire through the plating line or resin coating line provided apart from said wire drawing machine.
[0003]In recent years, the needs of the extra fine wire of 10-15 micrometers or a still thinner wire size have grown with the miniaturization of electrical and electric equipment, such as a cellular phone. However, if wire drawing of such an extra fine wire is carried out with said capstan type continuous wire drawing machine, in the drawing-out tension at that time, cannot bear a strand and it will be disconnected in many cases. Although mixing of a foreign matter and the surface crack of a strand generate an open circuit owing to, even if it is the detailed foreign matter and crack which are satisfactory practically, it may become a cause of an open circuit.
[0004]
[Problem(s) to be Solved by the Invention]In order to prevent the open circuit at the time of such manufacture, drawing-out tension, a lubricating oil, dice shape, etc. are examined, and the method of performing "peeling processing" further in the middle of an improvement of the mechanical properties of material or a wire-drawing process, and removing a foreign matter and a surface crack is examined, but. It has not come to acquire effect with any sufficient method. On the other hand, the foreign matter exposed to the surface reduces the adhesion of a metal plating layer, and a surface crack has the problem of becoming causes, such as a fall of the adhesion of a resin coating layer, and bulging.
[0005]The extra fine wire which the purpose of this invention excelled [extra fine wire] in surface quality, and fitted electrical-and-electric-equipment wiring, It is in providing the manufacturing method of the metal plating extra fine wire which plated metal to said extra fine wire, the resin coating extra fine wire which covered resin to said extra fine wire, and said extra fine wire, the manufacturing method of said metal plating line, and the manufacturing method of said resin coating extra fine wire.
[0006]
[Means for Solving the Problem]The invention according to claim 1 is an extra fine wire, wherein the diameter of a conductive strand by which wire drawing was carried out with a wire drawing machine is reduced by the chemicals dissolution or the electrochemistry dissolution.
[0007]The invention according to claim 2 is a metal plating extra fine wire, wherein metal is plated by the extra fine wire according to claim 1.
[0008]The invention according to claim 3 is a resin coating extra fine wire, wherein resin is covered by the extra fine wire according to claim 1.
[0009]The invention according to claim 4 is a manufacturing method of an extra fine wire reducing the diameter of a conductive strand by which wire drawing was carried out with a wire drawing machine by the chemicals dissolution or the electrochemistry dissolution.
[0010]The invention according to claim 5 is a manufacturing method of a metal plating extra fine wire giving continuously a process which reduces the diameter of a conductive strand by which wire drawing was carried out with a wire drawing machine by the chemicals dissolution or the electrochemistry dissolution, and is used as an extra fine wire, and a process of plating metal to said extra fine wire.
[0011]The invention according to claim 6 is a manufacturing method of a resin coating extra fine wire giving continuously a process which reduces the diameter of a conductive strand by which wire drawing was carried out with a wire drawing machine by the chemicals dissolution or the electrochemistry dissolution, and is used as an

extra fine wire, and a process of covering resin to said extra fine wire.
[0012]The invention according to claim 1 is the extra fine wire which reduced the diameter of a conductive strand by which wire drawing was carried out with a wire drawing machine to a required diameter by the chemicals dissolution or the electrochemistry dissolution. In order to reduce the diameter of this extra fine wire by the dissolution, dissolution removal of the wire drawing crack of a conductive strand is carried out, and a crack does not occur during diameter reduction, and it is quality. Since this extra fine wire does not require big tension during manufacture, an open circuit cannot get up furthermore easily. Although arbitrary conductive materials are used for said conductive strand, pure copper, a copper alloy, pure aluminium, an aluminum alloy, etc. are excellent in processability, and low cost, and especially preferred. As for a wire size of said conductive strand, 15–100 micrometers is preferred, and in less than 15 micrometers, a possibility that a surface crack of the depth which cannot fully be removed by diameter reduction by the next dissolution may occur is in a wire drawing process, and if it exceeds 100 micrometers, cost will come to start diameter reduction by the dissolution.
[0013]A usual acidic solution or alkaline liquid is used for said chemicals dissolution or the electrochemistry dissolution. That is, when carrying out the chemicals dissolution of copper or the copper alloy strand, chloride, sulfuric acid, phosphoric acid, a nitric acid system acidic solution or sodium hydroxide, potassium hydrate system alkalinity liquid, etc. are used. When carrying out the electrochemistry dissolution, chloride, sulfuric acid, phosphoric acid, a nitric acid system acidic solution or potassium cyanide, a sodium cyanide, sodium hydroxide, potassium hydrate system alkalinity liquid, etc. are used. When chemicals–dissolving or electrochemistry dissolving aluminum or an aluminum alloy, chloride, sulfuric acid, phosphoric acid, a nitric acid system acidic solution or sodium hydroxide, potassium hydrate system alkalinity liquid, etc. are used.
[0014]In this invention, as for wire–size reduction speed by the dissolution, the amount of 0.1–20–micrometer/is desirable, in order for the following to take a long time by 0.1–micrometer/obtaining a necessary wire size, melting equipment becomes huge and an installation cost becomes high. Appearance shape becomes uneven in order that the dissolution may progress rapidly, if a part for 20–micrometer/is exceeded. In this case, it is good to give a skin pass of 10% or less of the reduction of area after diameter reduction by the dissolution, and to prepare a surface disposition. Concentration of a solution is adjusted according to wire–size reduction speed made into the purpose. Generally 5% – 30% of range is preferred. In order to make good the homogeneity of the dissolution, or smooth nature of a wire surface after the dissolution, a surface–active agent may be added to a solution.
[0015]Although current density in the electrochemistry dissolution is also adjusted according to wire–size reduction speed made into the purpose, generally the range of 2 A/dm^2 – 50 A/dm^2 is preferred. As for acidic solutions after use, it is preferred for electrolysis etc. to recover a part for metal and to press down waste fluid to minimal dose.
[0016]As for an extra fine wire manufactured as mentioned above, metal plating is performed and a sex with solder, conductivity, corrosion resistance, etc. are usually improved. As a plated metal, the usual plated metals, such as tin, gold, silver, nickel, palladium, or these alloys, are applicable. As for said extra fine wire, resin coating is performed, and insulation is given and corrosion resistance is improved. Polyethylene of thermoplastics besides enamel, polystyrene, polyvinyl chloride, polyamide, etc. are applied to said resin.
[0017]In this invention, a reducing process by the chemicals dissolution or the electrochemistry dissolution, and metal plating or a resin coating process is performed continuously, without being interrupted. Thus, after a reason for performing both processes continuously rolls round an extra fine wire after said reducing process to a coiler and conveys this on another line, when metal plating or resin coating is performed, it is because a crack is attached at the time of conveyance and a quality metal plating extra fine wire or a resin coating extra fine wire becomes difficult to get.
[0018]A figure explains concretely a manufacturing method of a metal plating extra fine wire of this invention below. Drawing 1 is a routing description figure showing an embodiment of a manufacturing method of a metal plating extra fine wire of this invention. In a complete diagram for describing an embodiment, what has the same function attaches identical codes, and explanation of the repetition is omitted. Here, a reducing process and a metal plating process by the electrochemistry dissolution are included in an identical line. To the conductive strand 2 which it lets out from the recoiler 1, namely, degreasing with the degreasing bath 3, Perform each processing of (rinsing) and the surface dissolution by the electrochemistry dissolver 4, and it is considered as the extra fine wire 5 (reducing process according [the above] to the dissolution), Then, each processing of washing by degreasing, (rinsing), washing with the pickling tank 7, (rinsing), metal plating in the plating bath 8, the rinse tank 9, and the hot–water–rinsing tub 10 in the degreasing bath 6 and desiccation with the oven 11 is performed to the extra fine wire 5, it is considered as the metal plating extra fine wire 12 (above metal plating process), and this is rolled round to the coiler 13. A power feeding roll for diameter reduction or plating according [14] to the electrochemistry dissolution and 15 are guide rolls in drawing 1. There is also a place which omitted a rinse tank in drawing 1.
[0019]Next, a figure explains concretely a manufacturing method of a resin coating extra fine wire of this invention. Drawing 2 is a routing description figure showing an embodiment of a manufacturing method of a resin coating extra fine wire of this invention. This manufacturing method is what transposed a metal plating process shown in drawing 1 to a resin coating process, the extra fine wire 5 whose diameter was reduced by the dissolution applies resin by the resin spreading tub 16 succeedingly, and said resin is baked at the following printing furnace 17, and it processes it into the resin coating extra fine wire 18 here.
[0020]In this invention, in this way, since a reducing process by the dissolution, a metal plating process, or a reducing process and a resin coating process by the dissolution is performed continuously in an identical line, a metal plating extra fine wire with good surface quality or a resin coating extra fine wire is obtained.

[0021]
[Example]Below, an example explains this invention in detail.
(Example 1) The diameter of the copper strand which carried out wire drawing to 20 micrometers of wire sizes with the capstan type continuous wire drawing machine was reduced to the extra fine wire of 14 micrometers of wire sizes by the electrochemistry dissolution. Electrolytic degreasing of the copper strand which carried out wire drawing was carried out, and said electrochemistry dissolution was performed by passing the inside of a cell with a length of 2.5 m which subsequently stored with the temperature of 30 **, and a concentration of 50g/l. sulfuric acid the speed for 80-cm/. Here, average current density was set as 5 A/dm^2. Diameter reduction by this dissolution was repeated and the number of times of an open circuit (four lots) was counted. A result is shown in Table 1.
[0022](Comparative example 1) Wire drawing of the copper strand of 20 micrometers of the same wire sizes as having used in Example 1 was carried out with the wire drawing machine to 14 more micrometers. Said wire drawing was repeated and the number of times of an open circuit (four lots) was counted. The result was written together to Table 1.
[0023]
[Table 1]

分類	材料	加工方法		ロット No	20～14μm 断線回数
		440～20μm	20～14μm		
本発明例	銅線	伸線加工法	電気化学溶解法	1	1
				2	0
				3	0
				4	0
		平均値			0．25

分類	材料	加工方法	ロット No	20～14μm 断線回数
		440～14μm		
比較例	銅線	伸線加工法	1	5
			2	7
			3	4
			4	8
		平均値		6

[0024]There was little number of times of an open circuit of the example of this invention remarkably at an average of 0.25 times per lot/one kg compared with 6 times of a comparative example so that clearly from Table 1. This is because as for the extra fine wire of the example of this invention dissolution removal of the crack in wire drawing was carried out, diameter reduction slander did not arise, since the diameter was reduced by the dissolution, and big tension [as / in wire drawing] was not further applied during diameter reduction.
[0025](Example 2) The diameter of the copper strand which carried out wire drawing to 20 micrometers of wire sizes with the capstan type continuous wire drawing machine was reduced to the extra fine wire of 14 micrometers of wire sizes according to the electrochemistry melting process of the manufacturing method shown in drawing 1, and silver was succeedingly plated in 2-micrometer thickness by the metal plating process. Electrolytic degreasing of the copper strand which carried out wire drawing was carried out, and said electrochemistry dissolution was performed by making it pass the speed for 80-cm/into the cell with a length of 5 m which subsequently stored with the temperature of 30 **, and a concentration of 50g/l. sulfuric acid. Average current density was set as 2.5 A/dm^2 here. This diameter reduction and plating process were repeated, and the silver plating extra fine wire of nine lots was obtained.
[0026](Comparative example 2) The extra fine wire of 14 micrometers of wire sizes which carried out wire drawing with the capstan type continuous wire drawing machine was conveyed on the plating line, and silver was plated to said extra fine wire at 2-micrometer thickness. This plating treatment was repeated and the silver plating extra fine wire of nine lots was obtained.
[0027]About each silver plating extra fine wire obtained by Example 2 and the comparative example 2, the adhesion of the silver plating layer was investigated by the following 2 method. The 1st method cut said silver plating extra fine wire in length of 200 mm, and counted the number in which the twisting examination of every three per one lot of these was done, and the metal skin exfoliated. The 2nd method cut said silver plating extra fine wire in length of 1 m, heated this for 10 minutes at 300 **, and counted the bulging generated number of the metal skin. A result is shown in Table 2.
[0028](Example 3) Reduce the diameter of the copper strand which carried out wire drawing to 20 micrometers of wire sizes with the capstan type continuous wire drawing machine to the extra fine wire of 14 micrometers of wire sizes according to the electrochemistry melting process of the manufacturing method shown in drawing 2, and succeedingly at a resin coating process. The enamel of a polyurethane system was applied as resin, and this was heated for 1 minute at 500 **, and it was able to be printed. This enamel coating treatment was repeated and the enamel covering extra fine wire of nine lots was obtained.
[0029](Comparative example 3) The extra fine wire of 14 micrometers of wire sizes which carried out wire drawing with the capstan type continuous wire drawing machine was conveyed on the resin coating line, and the enamel of a polyurethane system was applied to said extra fine wire as resin, and this was heated for 1 minute at 500 **, and it was able to be printed. This enamel coating treatment was repeated and the enamel covering extra fine wire of nine lots was obtained.
[0030]It blistered about each enamel covered wire obtained by Example 3 and the comparative example 3, and the

generated number was counted. A result is written together to Table 2.
[0031]
[Table 2]

分類	材料	加工方法		ロットNo	銀めっき層		エナメル被覆の膨れ③
		440～20μm	20～14μm		剥離①	膨れ②	
本発明例	銅線	伸線加工法	電気化学溶解法	1	0	0	0
				2	0	0	0
				3	0	1	1
				4	1	0	0
				5	0	0	0
				6	0	0	0
				7	0	0	1
				8	0	0	0
				9	0	0	0
		平均値			0.11	0.11	0.22

分類	材料	加工方法	ロットNo	銀めっき層		エナメル被覆の膨れ③
		440～14μm		剥離①	膨れ②	
比較例	銅線	伸線加工法	1	1	2	3
			2	0	1	0
			3	3	3	0
			4	1	2	5
			5	0	0	0
			6	0	0	0
			7	2	3	3
			8	1	2	0
			9	3	2	2
		平均値		1.22	1.67	1.44

(注) 銀めっき層（厚さ2μm）の①剥離本数。②1mあたりの膨れ発生個数。
③エナメル被覆層の1mあたりの膨れ発生個数。

[0032]In the exfoliation number (average value) of a silver plating layer, in the example of this invention, 0.11 and a bulging generated number (average value) all had few bulging generated numbers (average value) of 0.11 piece and enamel covering at 0.22 piece so that clearly from Table 2. Since the extra fine wire of the example of this invention was excellent in surface quality, this is because the crack by conveyance was not attached. On the other hand, there was [in a comparative example] much each average value respectively at 1.22, 1.67 pieces, and 1.44 pieces. The crack to which this was attached at the time of conveyance is the cause.
[0033]As mentioned above, it checked that the same effect was acquired even if it reduces the diameter by the chemicals dissolution although the case where the diameter was reduced by the electrochemistry dissolution was explained by the experiment conducted separately.
[0034]
[Effect of the Invention]As stated above, since the extra fine wire of this invention is what reduced the diameter of the conductive strand by which wire drawing was carried out by the chemicals dissolution or the electrochemistry dissolution, it is excellent in surface quality. Since the metal plating extra fine wire or resin coating extra fine wire of this invention is what plated metal to the extra fine wire which is excellent in said surface quality, or covered resin, defects, such as bulging, do not produce it easily. Said extra fine wire can manufacture a long article easily using the usual solution. Said metal plating extra fine wire continues after manufacture of said extra fine wire, and by carrying out metal plating, said resin coating extra fine wire continues after manufacture of said extra fine wire, and can be manufactured with with high quality and sufficient productivity by carrying out resin coating again. Therefore, a prominent effect is done so on industry.

[Translation done.]

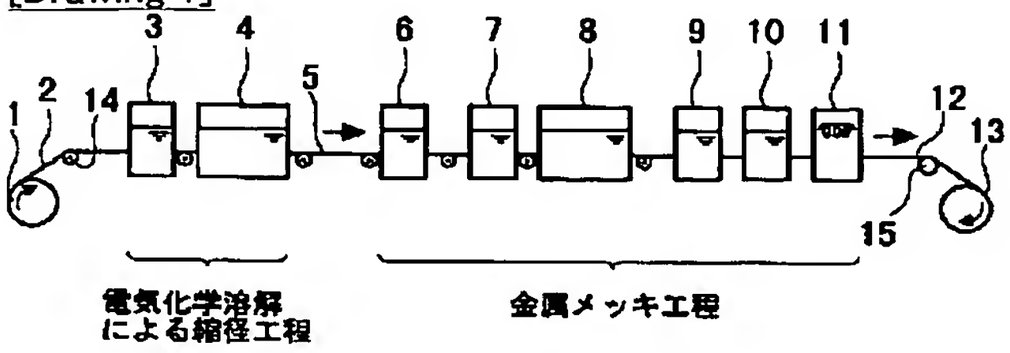
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a routing description figure showing the embodiment of the manufacturing method of the metal plating extra fine wire of this invention.
[Drawing 2]It is a routing description figure showing the embodiment of the manufacturing method of the resin coating extra fine wire of this invention.
[Description of Notations]
1 Recoiler
2 A conductive strand
3 Degreasing bath
4 Electrochemistry dissolver
5 Extra fine wire
6 Degreasing bath
7 Pickling tank
8 Plating bath
9 Rinse tank
10 Hot-water-rinsing tub
11 Oven
12 Metal plating extra fine wire
13 Coiler
14 Power feeding roll
15 Guide roll
16 Resin spreading tub
17 Printing furnace
18 Resin coating extra fine wire

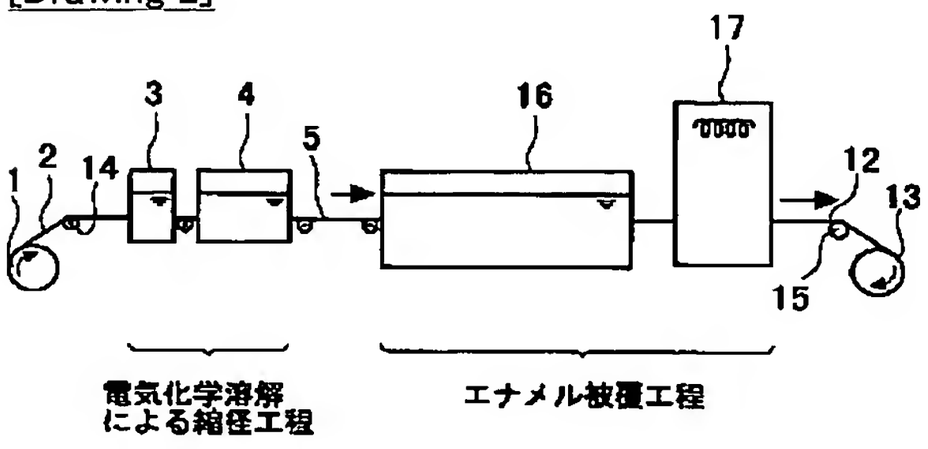
[Translation done.]

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]

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			５０１Ｅ	

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5G309 MA15

(54)【発明の名称】　極細線、金属メッキ極細線、樹脂被覆極細線、前記極細線の製造方法、前記金属メッキ極細線の製造方法、および前記樹脂被覆極細線の製造方法

(57)【要約】
【課題】　表面品質に優れ、電気・電子機器配線に適した極細線を提供する。
【解決手段】　伸線機により伸線加工された導電性素線２が化学溶解または電気化学溶解により縮径された極細線５。
【効果】　本発明の極細線５は導電性素線２を化学溶解または電気化学溶解により縮径したものなので表面品質に優れ、これを用いた金属メッキ極細線１２または樹脂被覆極細線は膨れなどの欠陥が生じ難い。